complicating factors as chronic infection, anemia, or malnutrition.

The cardiac neuroses which Doctor Scott has discussed so completely might well be included under the heading of "functional disorders." In this instance the primary trouble consists in an instability of the nervous system. Thus we see that disorders in almost any other system of the body may be reflected in abnormalities of the heart. These must be clearly distinguished from those cardiac disturbances due to organic lesions.

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ROBERT EWART RAMSAY, M. D. (65 North Madison Avenue, Pasadena)—When we speak of rheumatism we invariably include arthritis in the clinical picture, and usually we emphasize this element to the point where the heart is just one of the organs affected, even if it is the most important organ sharing in the infectious process. Doctor Scott devotes too little attention to arthritis in view of the fact that his title and introduction indicate that this is an inseparable part of his thought. As a matter of fact, arthritis and endocarditis may have a common focus of infection and a single causative agent and may exist together or separately. Since it is so difficult to accept a history of past arthritis, and equally difficult to evaluate a present arthritis, the real emphasis is on the causative agent and its effect on the heart. Infection of the tonsils, rather than arthritis, is commonly associated, and it is the study of diseases of the throat, rather than of the joints, which has helped to illuminate the question of endocarditis.

The existence of heart murmurs in the malnourished or rapidly growing child is deservedly emphasized in this paper. A diagnosis of heart disease is too often made, with the result that the child and its parents develop neuroses. I have in mind a young girl who was greatly incommoded and whose parents were much worried by such a diagnosis which might have been obviated if the physician who was responsible had known the normal behavior of a child's heart and had applied a few simple measurements and tests.

Doctor Scott has presented his subject in terse, forcible form. Clinical experience is evident in every line. It constitutes a challenge to keener observation and more accurate diagnosis.

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ANDREW J. THORNTON, M. D. (3235 Fourth Street, San Diego)—In the discussion of heart disease in children we should not limit consideration to the endocardium. One's mind should be open to the possibility of associated myocarditis or even a pancarditis. In fact I believe that the heart muscle is more often simultaneously involved with the endocardium than is generally supposed. Also in many cases of pericardial scratching sound without pain may be heard which is most likely evidence of a pericarditis.

We see very little frank rheumatism in San Diego, but much of the vague joint pains, leg ache, and complaint of pain in the "stomach." I have in mind one case in which the abdominal symptoms were so prominent that the heart condition was overlooked for several months.

Increased pulse rate and a persistent rise of temperature in the presence of infected tonsils or nasopharynx, even without demonstrable enlargement or heart murmur, should make us suspect very strongly a beginning heart disease. These early cases are the important ones to catch, as they are so easily overlooked. I believe that many of the so-called primary infections are in reality second attacks.

Differential diagnosis of organic heart disease from congenital or functional I agree is often very difficult or even impossible without observation over a period of time, but when there are reasonable grounds for suspecting infection we should not be afraid to run the risk of a little worry on the part of parent or patient. Heart disease is such a serious thing that the whole truth should be known by the parent and some responsibility put upon the patient when old enough.

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DOCTOR SCOTT (closing)—The pertinent comments on this subject by Doctor Washburn are well taken. It was not the intention in this article to enter too deeply into differential diagnosis except as was necessary to bring out the essential points. No article is so complete but that a discussor can add something of value if he is observant; consequently, I appreciate Doctor Washburn's remarks.

I wish to thank Doctor Ramsay and Doctor Thornton for their comments, but wish again to remind them that this paper was one of a symposium on rheumatic endocarditis, and that the other papers took up some of the details purposely omitted or only lightly touched upon.

CONSERVATION OF HEARING AND THE HARD-OF-HEARING CHILD*

By FRANK S. RODIN, M. D.
San Francisco

DISCUSSION *by Isaac H. Jones, M. D., Los Angeles; Vern O. Knudsen, Ph.D., Los Angeles; William C. Hassler, M. D., San Francisco; John A. Bacher, M. D., San Francisco.*

ONE of the most serious handicaps to any child is an impairment of hearing. Even a moderate degree of deafness is often an obstacle in the education of the young. One of the chief causes of retardation and inattention in class work is difficulty in hearing.

The term deaf child applied to one who has a moderate loss of hearing is an unfortunate one; the word "deaf" unduly alarms the parents and the child. These children are not deaf; they are hard of hearing, and should be called hard-of-hearing children.

A diminution in the acuity of hearing in early life, if not corrected, often progresses to a marked loss of hearing in later years. The question of the hard-of-hearing child and the rapid method of examining the hearing of children were discussed by Newhart[1] and by Fowler and Fletcher[2] at the American Medical Association annual meeting held at Dallas in 1926. The methods previously used, namely, the "watch-tick," "whispered

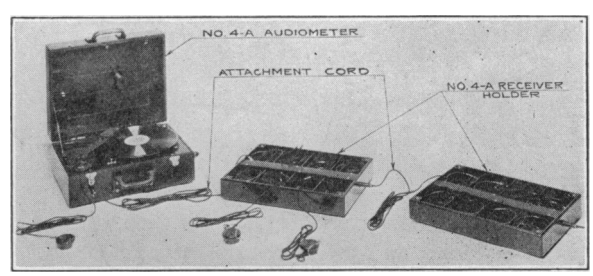

Fig. 1—The phonograph audiometer.

voice," and the tuning forks, are very unsatisfactory and consume too much time. The phonograph audiometer (Western Electric Company, 4-A) (Fig. 1) offers a means by which a large

* From the Division School Health Inspection, Department of Public Health, San Francisco.

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Fig. 2—Testing of children.

number of individuals may be tested in a short time. Briefly stated, the instrument consists of a phonograph and records through which speech vibrations, consisting of numbers, are conducted to the telephone receivers attached to the hearers' ears. Forty persons can be tested at one time. Fig. 2 shows arrangement of such a group. Blank forms (Fig. 3) are distributed to the children on which they write numbers as they hear them. The forms are then compared with master sheets. For a fuller description of this instrument one should refer to the papers by Newhart and by Fowler and Fletcher.

EXAMINATION METHOD

The San Francisco Board of Health, in cooperation with the Board of Education, has undertaken a systematic survey of the hearing of school children, from grade four through junior high school. This will include the children from the ages of 9 to 16 years. Grade four was chosen as a starting point because the children of that age are old enough to cooperate with the examiner.

A technician, supplied by the Board of Education, using the phonograph audiometer, tests not only the children of the above grades, but also those children of the lower grades who, in the opinion of the principal or teachers, have some difficulty in hearing. Those children who have a loss of nine or more sensation units in one or both ears are retested. The children who on a retest still show a loss of nine or more sensation units in one or both ears are examined by the Board of Health otologist, who makes such tests as he thinks are necessary for the proper diagnosis of the child's ear condition and records them on the back of the blank form used by the child (Fig. 4). The otologist examines the children with two ideas in mind: first, to discover the cause or causes producing loss of hearing; and second, to find children with such impairment of hearing that they are in need of lip-reading instruction. With the first type of children, the parents are notified by a card (Fig. 5) calling attention to their child's correctable defect. The names of children who need lip-reading instruction are given to the Board of Education. A record is kept of the children who have a loss of hearing insufficient to justify lip-reading instruction. These children are retested after a year's time. It is the object of the Board of Health to test all the school children every two years.

Fourteen grammar schools and three junior high schools have been examined, consisting of 3154 boys and 3068 girls, a total of 6222 children. Of these 1064 children, or 17 per cent, showed a loss of nine or more sensation units in one or both ears. On retesting these children, only 533, or 8.5 per cent, showed a loss of hearing of nine

DEPARTMENT OF PUBLIC HEALTH, SAN FRANCISCO, CALIF.

DIVISION SCHOOL HEALTH INSPECTION **HEARING TEST REPORT**

NAME_____ **AGE**_____

SCHOOL_____ **GRADE**_____ **DATE**_____ **19**____

HEARING LOSS	RIGHT EAR 1	2	3	4	LEFT EAR 5	6	7	8	HEARING LOSS
30									30
27									27
24									24
21									21
18									18
15									15
12									12
9									9
6									6
3									3
0									0
—3									—3

HEARING LOSS HEARING LOSS

Any history of ear trouble?.....

Fig. 3—Blank form for use by child.

or more sensation units in one or both ears. These children and others who gave a history of a recent ear condition were examined by the otologist, a total of 617 children.

CORRECTABLE DEFECTS

The following correctable defects were found: Hypertrophied tonsils and adenoids, 46; postnasal discharge and nasal obstruction, 6; discharging ears, 35; impacted cerumen in one ear, 42; impacted cerumen in both ears, 28. Total number of defects, 157.

This is 2.5 per cent of all children tested and 25 per cent of those examined by the otologist. To this list of defects should be added drums with marked retraction, large dry perforations, and granulations, which may give under treatment an improvement in hearing.

There were 208 notification cards sent to the parents. Ninety-nine children were referred for lip-reading instruction, that is, 1.6 per cent of all children tested and 17 per cent of the children who had a loss of nine or more sensation units in one or both ears.

It is unnecessary to discuss fully the relation of the defects found to the loss of hearing. The close relation between hypertrophied tonsils and adenoids to impaired hearing is well known to all otologists. The same relation exists between impaired hearing and postnasal discharge and nasal obstruction.

Although thirty-five children with discharging ears are reported, the number is really much

Date.....19.....

Complaint .....

.....

.....

	RIGHT	LEFT
Whisper		
Watch		
Weber		
Rinne		
Schwabach		
C-1		
C-4		
Phono-Audiometer		
Audiometer A-2		
Ear Drums		

Throat Examination.....

Whispered Conversation.....

Comment.....

.....

Recommendations: Lip-Reading Class.....

Card .....

Retest .....

None .....

Fig. 4—Blank form for use of otologist: C-1 = 64 d. v.; C-4 = 2048 d. v.

DEPARTMENT OF PUBLIC HEALTH
San Francisco, California
DIVISION OF CHILD HYGIENE

HEARING CONSERVATION

Name of child.....attending

.....School, was found to have defective hearing. Kindly have the child examined and return this card to SCHOOL NURSE.

.....
Health Officer.

RECORD OF PHYSICIAN'S EXAMINATION
(To be filled out by physician and treated as confidential)

Condition of hearing { R / L

Drum membrane { R / L

Treatment recommended.....

.....

Is condition permanent, stationary or improved under treatment?

.....

Remarks .....

Date.....19..... Examiner.....M. D.

Fig. 5—Notification card sent to parents, and record of physician's examination to be written on the reverse side of card.

larger, as only such were included as had pus in the ear canal at the time of examination. Those who gave a history of recurrent discharging ears and those who were under treatment and had clean ears when examined were not included. Discharging ears under proper treatment can often be cured with resulting improvement of hearing or with the prevention of further loss of hearing. The majority of the children with discharging ears had had little or no medical attention and were not under medical care when examined. Some of the children with impacted cerumen gave a history of a long-standing impaired hearing of the affected ear.

IMPAIRMENT NECESSITATING LIP-READING INSTRUCTION

It is not always easy to decide just how much loss of hearing incapacitates a child so that lip-reading instruction is necessary. Children will vary: one child with normal hearing in one ear and a total loss of hearing in the other ear will have no difficulty in following a whispered conversation, and may even be unaware of the fact that he has one deaf ear; another child with normal hearing in one ear and a moderate loss of hearing in the other, say a loss of twenty-one sensation units, will be backward in his school work, have difficulty in hearing and be absolutely unable to follow a whispered conversation. All factors have to be considered, such as type of deafness, condition of ear drums, improvement expected under treatment, response to whispered conversation, and scholastic record before recommending the child for lip-reading instruction. A consultation with the principal or teacher may be of aid in making the decision.

The finding of almost one child out of fifty, between the ages of nine and sixteen years, with impairment of hearing sufficient to necessitate lip-reading instruction justifies the systematic and periodic examination of the hearing of all school children to locate defects that, uncorrected, eventually lead to permanent loss of hearing.

490 Post Street.

REFERENCES

1. Newhart, H.: Diagnostic School Clinic in the Public Schools as Factor in Conservation of Hearing, J. A. M. A., 87:1882, December 4, 1926.

2. Fowler, E. P., and Fletcher, H.: Three Million Deafened School Children, J. A. M. A., 87:1877, December 4, 1926.

DISCUSSION

ISAAC H. JONES, M. D. (1920 Wilshire Boulevard, Los Angeles)—The average case with chronic deafness presents one of the most discouraging problems that come to the otologist. Examination often shows that time for corrective measures has passed. For this reason we all are coming to realize that the great hope lies in prevention, or at least in the early correction of defects that are beginning to produce chronic changes in the auditory mechanism. With this in mind Professor Knudsen and I suggested to the school authorities in Los Angeles a year and a half ago that a systematic study could be made by the means of instruments which could be used by those not trained in otology.

Our plan has been different from that outlined by Doctor Rodin only in the detail of the method of conducting the test. It seems to us that by taking groups of perhaps sixteen one could "weed out" the normals in a minute or two. This would be accomplished simply by getting the percentage hearing for the 64 d. v. and determining the upper limit of hearing. If these are normal it is evident at once that there is probably no conductive defect, nor perceptive defect. These children could be dismissed at once and another series of sixteen similarly tested. Then, for example, if out of a series of four groups of sixteen there should prove to be three or four or more who were not normal, these individuals could have complete precise measurements made. A carbon copy would then be sent to the parents, who could take it to their otologist; the original would be kept for statistical purposes in the hands of the school authorities.

The Western Electric phonograph which Doctor Rodin uses is most ingenious and a very beautiful instrument. It is possible, however, that the quicker test of simply taking the lower and upper tones might not only save time, but give more information as to the nature of the defect than the phonograph test, which is limited to the range of the voice.

Those who have given thought to this subject all agree on the main essential—that systematic measurements with instruments of precision will bring out beginning hearing defects, in many instances perhaps five or ten years before these defects will be so gross as to be noticed by those with whom the children have ordinary conversation. The inauguration of this sort of work is surely a real civic opportunity for service.

VERN O. KNUDSEN, Ph.D. (The University of California, at Los Angeles)—The work begun by Doctor Rodin at San Francisco deserves the attention of all public-spirited school authorities and otologists. It is difficult to estimate the value which will come from such a survey, but the wisdom of undertaking this

work, especially among the younger pupils, is unquestioned.

The discussion by Doctor Jones, of course, represents my views of the subject. The precise details of the manner in which this work is done is not so important as that Doctor Rodin has actually started this work in San Francisco. Doctor Jones and I have slightly different views in regard to the manner of conducting these group tests, but this should in no way confuse the subject. In the method which we proposed before the Pacific Coast section of the American Otologic Rhinologic and Laryngologic Society at its January, 1926, meeting the data of which are obtained in the quick group test are useful, but must be supplemented by additional measurements. I am inclined to believe this quick group test facilitates both speed and accuracy.

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WILLIAM C. HASSLER, M. D. (Department of Public Health, 1085 Mission Street, San Francisco)—For years the Department of Health in its work with the school child has realized the importance of testing acuity of hearing and vision, not only to determine the cause of any deflection from the normal, but also to prevent the results that follow deviations from normal of both sight and hearing and which affect the progress of the child physically and mentally. Though physicians are competent to make examinations, it is impossible to have more than a very limited amount of work done, and as the school population increased the problem grew.

It was therefore with great pleasure that the Board of Health welcomed into the field the advent of the Western Electric Company's phonograph audiometer and placed Dr. Frank H. Rodin in charge of the first work done in this city, a résumé of which is clearly set forth in his paper prepared for the last meeting of the California Medical Association.

We realize there is still debate as to the value of the phonograph audiometer, and argument has been advanced by some otologists that the sound registrations using the lower or upper tones save time in the testing groups and give more information as to the nature of the defects than the phonograph does. This is the opinion of Doctor Jones of Los Angeles in his discussion. We believe that compelling the child to put down on paper the sound he hears from the phonograph registers definitely what he hears and results in less error than any other group tests with which we have had experience.

Of the 6222 children examined, it is interesting to note that a total of 617 were referred to the otologist, and out of these, 157 showed definite defects which were amenable to treatment and correction. Ninety-nine of these children were referred for lip-reading instruction; in other words 1.6 per cent were placed in classes that enable them to obtain instruction which will have a distinct bearing upon their future.

The conclusion of our department work for the fiscal year certainly justifies the extension of our efforts to bring under test the entire school population at the earliest possible moment.

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JOHN A. BACHER, M. D. (Lane Hospital, San Francisco)—Doctor Rodin's article clearly expresses the problems and difficulties that are encountered in endeavoring to conserve hearing. Any hearing test at best is subjective and therefore relative, not absolute. Improvements in instruments and their standardization will continue to give us a basis approaching more nearly the normal. The most valuable work along this line can be done if there is some means of locating those children who have only the very slightest degree of loss of hearing. For in these early cases rests our hope of reducing the astounding figure that one in sixty of the school children examined are subjects for lip-reading instruction. Conservation of hearing is entirely a matter of prophylaxis in diagnosing the process early and staying it.

I think it would be a little more intelligible to use percentages of loss of hearing rather than figures expressing loss of sensation units. I do not believe that the ordinary man reading this paper will understand the dividing line of nine sensation units loss of hearing which is the indication for re-examination. The fact that only half as many had a loss of nine or more sensation units upon the second test as did on the first test shows the importance of the subjective factor in the test and that the second test is the one that is important. I hope that five years from now or that ten years from now the method will have been so improved that hard-of-hearing children will be picked out in even earlier stages, and there will be no such astounding number as one in sixty requiring lip-reading instructions. This success or failure will be dependent in a large degree upon the care and attention which the private or clinic doctor to whom the child is referred gives to the patient, and how nearly normal he makes and keeps the nose and throat.

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DOCTOR RODIN (closing)—The importance of examining the hearing of school children is agreed to by the participants in this discussion. Doctors Jones and Knudsen have developed a very ingenious instrument for testing small groups, as mentioned by them. This instrument is based on sound vibrations, but I agree with Doctor Hassler that one cannot always depend upon a child's response to sound vibrations. The child may wish to assist the examiner by claiming that he hears a sound when he does not perceive it. With the phonograph audiometer the child is compelled to write down the numbers he hears. These numbers are then compared with the master sheets and the loss of hearing calculated therefrom.

Doctor Bacher is correct in stating that it would be more intelligible to use percentages of loss of hearing than expressing it in loss of sensation units. The phonograph audiometer is calibrated in sensation units, which is the unit adopted by Harvey Fletcher (see his New Methods and Apparatus for Testing the Acuity of Hearing, Laryngoscope 35:501, July, 1925), and to convert from hearing loss in sensation units to per cent hearing loss for speech, multiply by .83. It is the intention in future to state on the notification cards sent to the parents (Fig. 5) the percentage of loss of hearing.

Re-examination of all school children every two or three years with a suitable audiometer offers at present the best means of early recognition of loss of hearing, and the stage when treatment is of greatest value. I believe that such examinations with the proper cooperation of the parents, family physicians, and otologists will greatly reduce the number of children requiring lip-reading instruction.

Insects and Communicable Diseases—There are many types of mosquitoes in western states which are extremely pestiferous and their bites may be extremely painful. The salt-marsh mosquitoes are particularly aggressive, causing the keenest sort of discomfort to campers. While the bites of the anopheles mosquito may produce malaria, the bites of most other types found in the western states are seldom serious in themselves. They may lead to blood poisoning through scratching with the finger nails in an attempt to relieve the irritation, which is often very intense. To relieve the irritation, ammonia, glycerin, alcohol, or iodin may be applied. An application of moist toilet soap is also said to be effective in affording quick relief. Touching the bites with ordinary moth ball is also said to be effective. A weak solution of carbolic acid—about 2 per cent—is also useful in stopping the itching of a mosquito bite. Campers who visit districts where mosquitoes abound should carry a sufficient supply of ordinary mosquito bar in order that they may be protected against the attacks of these insects. This offers the best sort of protection.—*Weekly Bulletin, California Department of Public Health.*